REMARKS

Introductory Remarks

Claims 1-16 are all the claims pending in the application. Currently, claims 1-16 are rejected. In particular, the Examiner has rejected claims 1, 4-11 and 13-15 under 35 U.S.C. §102(b) as being anticipated by Muratomi (US 4,997,241). Claims 2-3, 12 and 16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Muratomi in view of Hashimoto (US 5,532,871.

Applicant thanks the Examiner for acknowledging the claim for foreign priority under 35 U.S.C. § 119, noting that the priority documents have been received. Applicant also thanks the Examiner for accepting the drawings as filed on January 7, 2002.

Applicants are amending the specification to correct various typographical errors that were overlooked when the application was filed, and are replacing all formerly pending claims 1-16 with new claims 17- 51.

Objection to IDS Filed April 5, 2002

Applicant thanks the Examiner for reviewing and indicating consideration of those of the documents filed in the Information Disclosure Statements (IDS) on April 5 and September 4, 2002, that the Examiner has initialed on the Applicant's Forms PTO-1449.

The Examiner indicates that the four remaining references not initialed, all of which were submitted with the Information Disclosure filed April 5, 2002, were not considered on the merits. According to the Examiner, these references, which are each in a foreign language, were not considered because "no English translation copy" was provided, and, therefore, the IDS "fails to comply with the provisions of 37 C.F.R. §1.97, 1.98 and MPEP § 609."

The grounds for objecting to the IDS of April 5, 2002, are in error. The four foreign language references should have been considered during this stage of examination. Accordingly, the Applicant requests the Examiner to remedy the error and indicate consideration of the references in the next Office Communication.

More particularly, Applicant refers the Examiner to page 2 of the IDS filed on April 5, 2002, which sets forth in detail the manner in which the Applicant complied with the concise explanation requirement under 37 C.F.R. §1.98(a)(3) and MPEP §609. MPEP §609(III)(A)(3) (Concise Explanation of Relevance for Non-English Language Information)(8th Edition) provides that the requirement for a concise explanation of relevance can be satisfied by submitting an English-language version of a search report or other action which indicates the degree of relevance found by the foreign office. Applicant submitted a copy of a German Search Report on April 5, 2002, indicating the degree of relevance found by the German Patent Office, and thereby satisfied the concise explanation requirement.

In addition to satisfying the concise explanation requirement in accordance with MPEP §609(III)(A)(3), the Applicant provided the Examiner with additional guidance on page 2 of the IDS filed on April 5, 2002, by noting that the relevance of DE 198 31 392 is discussed in the Background section of the present application and that DE 21 65 315 has an English language counterpart in U.S. Patent No. 3,936,136.

For the Examiner's convenience, Applicant is enclosing herein a duplicate copy of the Search Report filed with the above-mentioned Information Disclosure Statement as well as a new Form PTO-1449 listing again specifically the four references at issue. Applicant respectfully requests the Examiner to consider these four remaining references cited in Applicant's

Information Disclosure Statement of April 5, 2002, and to return the enclosed Form PTO-1449 properly initialed.

Overview of New Claims 17-51

The present invention relates to optical components with a low reflectance for ultraviolet light in a wavelength range between approx. 180 nm and approx. 370 nm for high angles of incidence In the detailed description, the layer structures of four embodiments of antireflection (AR)-coatings are given by way of example as designs (1) to (4) using the geometrical thickness d of the respective layers and the respective layer material. In design (5), the respective layer thicknesses of the individual layers of embodiment (1) are given in terms of a fraction of the working wavelength λ. In paragraph [18] of the application, the refraction index n of the respective layer materials aluminium oxide (Al_2O_3) and magnesium fluoride (MgF_2) is given. The high refractive material (i.e. the material with the higher refractive index n, here Al_203) has a refraction index of approximately n = 1.69, whereas the low refractive material (here magnesium fluoride) has a refraction index of approximately n = 1.41 at λ = 248 nm.

In many of the documents of record, the layer thicknesses are given in terms of the optical layer thickness (n . d)/ λ, wherein d is the geometrical layer thickness, n is the refractive index and λ is the working wavelength. Since the parameters of geometrical layer thickness and optical layer thickness have a mathematically defined relationship, the present invention can be described and claimed in either manner. Accordingly, the new claims presented recite the invention recognizing the distinction in nomenclature between optical and geometrical layer thickness.

Unlike former claim 1, new independent claim 17 is directed to an optical component that has "at least six stacked layers," and that only two different materials (Al_2O_3 and MgF_2), one having a high refractive index and one having a low diffractive index, are used. The first layer (nearest to the substrate) is specified as high refractive aluminum oxide (thus being "substantially" free of magnesium fluoride). A further limitation regards the second layer, which may not exceed a certain layer thickness limit (optical thickness $\leq 0.33\ \lambda$). Further, none of the layers is geometrically thicker than about $0.5\ \lambda$. New claim 17 reads on and is supported by the various preferred embodiments disclosed in the detailed description of the application. The claims dependent on new claim 17 also read on and are supported variously by one or more of the preferred embodiments.

New independent claim 34 is directed to an optical component that has "multiple stacked layers," the second and third layers meeting specific criteria in optical thickness. Again, claim 34, and claims dependent thereon, read on and are supported by one or more of the preferred embodiments disclosed in the application.

New independent claim 50 is directed to an optical component that has "at least six stacked layers" that alternate between Al_2O_3 and MgF_2 and each meet specific criteria in optical thickness. Claim 50, and claims dependent thereon, read on and are supported by one or more of the preferred embodiments disclosed in the application.

Distinctions vis a vis the Prior Art

The newly presented claims distinguish clearly from the cited and applied prior art documents.

Muratomi (US 4,997,241) relates to a multi-layered antireflection film preventing reflection at two wavelength regions, such as ultraviolet regions and visible wavelength regions (col. 1, lines 8-17). Muratomi teaches, generally, using more than two different materials, for example four different materials (see, e.g., Fig. 2). The first layer has a low refractive index or a refractive index comparable to that of the substrate. The prior art discussed in connection Fig. 7 of Muratomi shows a conventional two-layer-quarterwave stack.

Thus, Muratomi fails to teach or suggest the combination of limitations recited in the new claims. Claim 17, for example, as noted above, is directed to an optical component that has "at least six stacked layers," wherein only two different materials (Al_2O_3 and MgF_2), one having a high refractive index and one having a low diffractive index, are used.

Hashimoto et al. (US 5,532,871) relates to a two-wavelength anti-reflection film capable of effective antireflection in two wavelength regions (col. 1, lines 8-13). In Table 3, the reference discloses only one coating with only two materials (aluminium oxide and magnesium fluoride). However, the system has only 4 layers. Accordingly Hashimoto et al. also fails to teach or suggest the combination of features recited in claim 17.

Otani et. al. (JP 11-142606 corresponding to US 6,472,087 B1) discloses antireflection coatings having only two materials, with aluminium oxide as high-index material and, optionally, magnesium fluoride as low-index material. The only disclosed system having six layers (see e.g. claim 3) has a second layer with optical thickness between 0.37 λ and 0.42 λ which is substantially thicker than the second layer according to claim 17.

In Otani et. al. (US 5,885,712), the layer thickness of the second layer is substantially larger in all embodiments than in the present invention. The second layer is the thickest layer of the entire coating, quite in contrast, e.g., to claim 17. Also, materials based on $Si0_2$ are used as the low-index material, leading to different design requirements -- $Si0_2$ has a higher refractive index than MgF_2. This demonstrates well the mutually different design philosophies employed between this prior art and the present invention.

Shirai (US 5,963,365) discloses designs with a maximum of four layers, using mostly fluoride materials as a high-index material.

The subject matter of claim 17, reciting, *inter alia*, "at least six stacked layers" and use of only two different materials ($A1_20_3$ and MgF_2), is therefore novel and distinguishes patentably over the prior art. Likewise, the subject matter of claim 34 is novel and unobvious over the prior art by reciting, *inter alia* specific rigorous requirements for the optical thickness of the second and third layers. Finally, the subject matter of claim 50 is also novel and unobvious in its combination of features recited.

Applicant notes that a dielectric multilayer coating must generally be evaluated holistically, as an entirety, since the dielectric layers of the systems act in combination of all layers by interference. Accordingly, mere substitutions of individual layers or parameters of layers are not feasible without regarding the effect of such substitution on the entire system.

The particular layer structures selected determines the optical characteristics, e.g. the spectral dependency of the reflection coefficient or the dependency of the reflection at a certain wavelength on incidence angle. Given an optimum design, like those disclosed in the present application, there is a gradual change of optical properties if the properties of the single layers

(layer thicknesses, refractive index) deviate from the optimum condition. Therefore it is often found that ranges for layer thicknesses for individual layers are given in order to characterize a design (compare for example the claims in US 6,472,087 B1).

Whereas each single design may be regarded as an individuum, a set of "good" coatings with similar properties may be created according to certain "design rules". The design rules normally depend on the boundary conditions under which a design is to be developed. For example, in the present invention, it was one object to design an AR-coating for UV having excellent AR-properties over a wide range of incident angles (0° up to 50°). Another object was to provide an AR coating that is highly resistant against laser beam irradiation.

The inventors of the claimed invention have discovered certain technical measures which, in combination, allow one to obtain highly efficient coatings which are resistant against fracturing in connection with delamination of the coating and which are practical from a fabrication point of view. Avoiding MgF_2 as the first layer greater fosters fracture resistance. A metal oxide, like aluminum oxide, is used instead. Using six or more layers proves useful to obtain optimum AR efficiency and bandwidth. Moreover, limiting the multilayer system to only two materials is good from a manufacturing point of view. Finally, high irradiation resistance in connection with optimum optical efficiency can be obtained by ensuring that the layer thicknesses do not exceed certain upper limits. Particularly the second (and third) layer and the MgF_2 layers were discovered to be important. The new claims presented represent these design insights.

Closing Remarks

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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